CLAIMS

1. A device comprising a NO_X removal system for removing nitrogen oxides from a nitrogen oxide containing exhaust, said NO_X removal system comprising a NO_X treatment section, a diverter, and a hydrogen generation section, wherein:

said NO_X treatment section is configured to remove nitrogen oxides from said exhaust;

said diverter is configured to enable delivery of water to said hydrogen generation section;

said hydrogen generation section is configured to deliver hydrogen to said NO_X treatment section; and

said NO_X removal system is configured such that said delivery of said hydrogen to said NO_X treatment section is substantially isolated from delivery of a substantial amount of oxygen to said NO_X treatment section.

2. A device as claimed in claim 1 wherein said exhaust comprises oxygen.

3. A device as claimed in claim 1 wherein said NO_X removal system is configured such that said delivery of said hydrogen to said NO_X treatment section is substantially isolated from delivery of said exhaust to said NO_X treatment section.

4. A device as claimed in claim 1 wherein said NO_X treatment section is configured to remove nitrogen oxides from said exhaust through adsorption.

5. A device as claimed in claim 4 wherein said NO_X treatment section comprises a plurality of catalyst beds.

6. A device as claimed in claim 1 wherein said NO_X treatment section comprises at least one NO_X adsorber.

7. A device as claimed in claim 1 wherein said NO_X treatment section defines at least two independent NO_X treatment zones.

8. A device as claimed in claim 7 wherein said independent NO_X treatment zones are defined by independent NO_X adsorbers.

9. A device as claimed in claim 7 wherein said independent NO_X treatment zones are defined by multiple catalyst beds packaged as a single NO_X adsorber unit.

10. A device as claimed in claim 7 wherein said NO_X removal system is configured to deliver said exhaust to one of said independent NO_X treatment zones on a selective basis.

11. A device as claimed in claim 10 wherein said delivery of said exhaust is affected by a flow diverter valve.

12. A device as claimed in claim 10 wherein said NO_X removal system is configured to deliver said hydrogen from said hydrogen generation section to one of said independent NO_X treatment zones on a selective basis.

13. A device as claimed in claim 12 wherein said NO_X removal system is configured to deliver said hydrogen and said exhaust to said NO_X treatment section such that each is delivered to different ones of said independent NO_X treatment zones on a selective basis.

14. A device as claimed in claim 1 wherein said diverter is positioned downstream of said NO_X treatment section.

15. A device as claimed in claim 1 wherein said diverter is configured to extract water from said exhaust.

16. A device as claimed in claim 1 wherein said diverter comprises a condensation unit or a semi-permeable membrane.

17. A device as claimed in claim 1 wherein said hydrogen generation section is configured to deliver an amount of hydrogen sufficient to affect desulfation of said NO_X treatment section.

18. A device as claimed in claim 1 wherein said hydrogen generation section is configured to deliver an amount of hydrogen sufficient to affect catalytic regeneration of said NO_X treatment section.

19. A device as claimed in claim 1 wherein said hydrogen generation section is configured to accumulate and store hydrogen.

20. A device as claimed in claim 19 wherein said hydrogen generation section further comprises a pressure monitor configured to monitor said accumulation and storage of hydrogen.

21. A device as claimed in claim 1 wherein said hydrogen generation section comprises an electrolysis unit.

22. A device as claimed in claim 1 wherein said hydrogen generation section comprises a hydrogen storage reservoir fed by a hydrogen output of said electrolysis unit.

23. A device as claimed in claim 1 wherein said hydrogen generation section is configured to deliver hydrogen to one of at least two independent NO_X treatment zones of said NO_X treatment section on a selective basis.

24. A device as claimed in claim 1 wherein said hydrogen generation section comprises at least one hydrogen injector.

25. A device as claimed in claim 1 wherein:

said hydrogen generation section comprises a pair of hydrogen injectors; and

each of said hydrogen injectors is in communication with different independent NO_X treatment zones of said NO_X treatment section.

26. A device as claimed in claim 1 wherein:

said device comprises an engine configured to generate torque; and

said engine generates said exhaust.

27. A device as claimed in claim 26 wherein said engine comprises a diesel engine.

28. A device as claimed in claim 26 wherein said engine is configured such that said exhaust is characterized by an oxygen content of about 1 to about 20 percent, by weight.

29. A device as claimed in claim 26 wherein:

said device comprises an electrical generator driven by said engine; and

said hydrogen generation section is powered by said electrical generator.

30. A device as claimed in claim 26 wherein said device comprises at least one exhaust treatment system in addition to said NO_X treatment section.

31. A device as claimed in claim 1 wherein said NO_X removal system comprises a controller programmed to control delivery of said exhaust to said NO_X treatment section.

32. A device as claimed in claim 31 wherein said controller is programmed to:

monitor a condition indicative of removal of said nitrogen oxides by at least one treatment zone of said NO_X treatment section; and

divert exhaust from said treatment zone when said treatment zone approaches its nitrogen oxide removal capacity.

33. A device as claimed in claim 32 wherein said controller is programmed to affect delivery of said hydrogen to said treatment zone following diversion of said exhaust from said treatment zone.

34. A device as claimed in claim 1 wherein said NO_X removal system further comprises a controller programmed to control delivery of said hydrogen to said NO_X treatment section.

35. A device as claimed in claim 34 wherein:

said NO_X treatment section defines at least two independent NO_X treatment zones; and

said controller is programmed to deliver said exhaust and said hydrogen respectively to different ones of said independent NO_X treatment zones.

36. A device as claimed in claim 34 wherein said controller is configured to monitor accumulation and storage of hydrogen in said hydrogen generation section.

37. A device as claimed in claim 36 wherein monitoring of said accumulation and storage of hydrogen is affected through a pressure monitor in communication with said controller.

38. A device as claimed in claim 1 wherein said device comprises:

a vehicle body or stationary device;

an engine configured to generate said exhaust and sufficient torque to accelerate said vehicle body or power said stationary device.

39. A method of operating a NO_X removal system to affect removal of nitrogen oxides from a nitrogen oxide containing exhaust, wherein said NO_X removal system comprises a NO_X treatment section, a diverter, and a hydrogen generation section, and wherein said method comprises:

directing said nitrogen oxide containing exhaust through said NO_X treatment section to affect removal of nitrogen oxides from said exhaust;

delivering water from said exhaust to said hydrogen generation section utilizing said diverter;

controlling delivery of said exhaust to said NO_X treatment section and hydrogen generated by said hydrogen generation section to said NO_X treatment section such that delivery of said hydrogen to said NO_X treatment section is substantially isolated from delivery of a substantial amount of oxygen to said NO_X treatment section.

40. A method of operating a NO_X removal system as claimed in claim 39 wherein said method comprises:

monitoring a condition indicative of removal of said nitrogen oxides by at least one treatment zone of said NO_X treatment section; and

diverting exhaust from said treatment zone when said treatment zone approaches its nitrogen oxide removal capacity.

41. A method of operating a NO_X removal system as claimed in claim 39 wherein said exhaust is diverted from said treatment zone to an independent treatment zone when said treatment zone approaches its nitrogen oxide removal capacity.

42. A method of operating a NO_X removal system as claimed in claim 39 wherein said method comprises delivering said hydrogen to said treatment zone following diversion of said exhaust from said treatment zone.

43. A method of operating a NO_X removal system as claimed in claim 42 wherein delivery of said hydrogen to said treatment zone is interrupted prior to diversion of said exhaust back to said treatment zone.

44. A method of operating a NO_X removal system as claimed in claim 39 wherein said method comprises:

monitoring a condition indicative of removal of said nitrogen oxides by said NO_X treatment section;

diverting exhaust from a selected treatment zone of said NO_X treatment section to an independent treatment zone of said NO_X treatment section as said selected treatment zone approaches its nitrogen oxide removal capacity; and

delivering said hydrogen to said selected treatment zone following diversion of said exhaust from said treatment zone to said independent treatment zone.

45. A method of operating a NO_X removal system as claimed in claim 44 wherein said hydrogen is delivered to said selected treatment zone for an amount of time sufficient to regenerate said nitrogen oxide removal capacity.

46. A method of operating a NO_X removal system as claimed in claim 45 wherein said exhaust is redirected to said selected treatment zone following regeneration of said nitrogen oxide removal capacity.

47. A method of operating a NO_X removal system as claimed in claim 45 wherein said exhaust is redirected to said selected treatment zone after delivery of hydrogen to said selected treatment zone is interrupted and as said independent treatment zone approaches its nitrogen oxide removal capacity.

48. A device comprising an engine and a NO_X removal system for removing nitrogen oxides from an exhaust generated by said engine, said NO_X removal system comprising a NO_X treatment section, a diverter, and a hydrogen generation section, wherein:

said exhaust comprises oxygen and nitrogen oxides;

said NO_X treatment section is configured to remove nitrogen oxides from said exhaust;

said diverter is configured to enable delivery of water to said hydrogen generation section;

said hydrogen generation section is configured to deliver hydrogen to said NO_X treatment section; and

said NO_X removal system is configured such that said delivery of said hydrogen to said NO_X treatment section is substantially isolated from delivery of a substantial amount of said oxygen in said exhaust to said NO_X treatment section.

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